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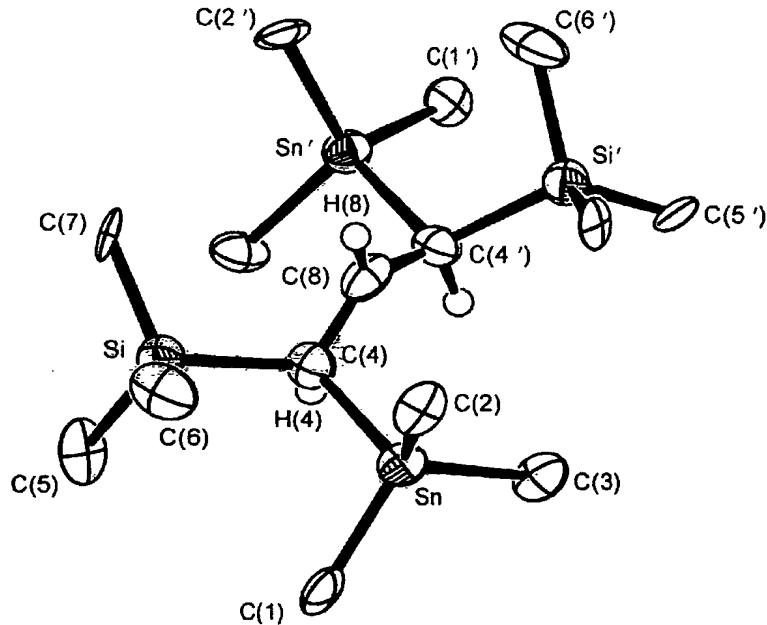
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[Continued on next page]

(54) Title: PROCESS FOR PREPARING ISOBUTYLENE-BASED POLYMERS



WO 03/062284 A3

(57) Abstract: This invention relates to a metal organic compound, a catalytic composition comprising said metal organic compound, a process for homo- or co-polymerizing isoolefines in the presence of said metal organic compound and a method of stabilizing a compound of the general structure (II)  $[R'HC(CRR'')]_2^{2+}[M_2X_9]^-$ , in which R is a group of the formula  $SiR^1R^2R^3$ , R" is hydrogen, C<sub>1</sub> to C<sub>12</sub> alkyl, a C<sub>6</sub> to C<sub>14</sub> aryl or a C<sub>7</sub> to C<sub>20</sub> alkylaryl, M is Zr or Hf, X is a halogen atom, and R<sup>1</sup> to R<sup>3</sup> is a C<sub>1</sub> to C<sub>12</sub> alkyl group, with a compound R' of the formula M'R<sup>4</sup>R<sup>5</sup>R<sup>6</sup>, in which M' is Si, Ge, Sn or Pb and R<sup>4</sup> to R<sup>6</sup> is a C<sub>1</sub> to C<sub>12</sub> alkyl group as well as a non-coordinating anion of the general structure [M<sub>2</sub>X<sub>9</sub>]<sup>-</sup> in which M is Zr or Hf and X is a halogen atom.

**Declaration under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB,*

*GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

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## INTERNATIONAL SEARCH REPORT

International Application No

P CA 00067

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C08F10/10 C08F210/12 C08F4/16 C07F7/22

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C08F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, CHEM ABS Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|------------|---|-----------------------|
| X          | CALDERAZZO F ET AL: "eta-Arene derivatives of titanium(IV), zirconium(IV) and hafnium(IV)"<br>JOURNAL OF ORGANOMETALLIC CHEMISTRY,<br>ELSEVIER-SEQUOIA S.A. LAUSANNE, CH,<br>vol. 518, no. 1,<br>12 July 1996 (1996-07-12), pages 189-196,<br>XP004035872<br>ISSN: 0022-328X<br>page 191, column 2, paragraph 1<br>page 194; figure 2<br>page 195, column 1, paragraph 4 -<br>paragraph 5<br>---<br>-/- | 11                    |

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

## ° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

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## INTERNATIONAL SEARCH REPORT

International Application No  
P CA 00067

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|----------|--|-----------------------|
| A        | OLAH G A: "LONG LIVED CARBOCATIONS"<br>CHEMICA SCRIPTA, PRESS SYNDICATE OF THE<br>CAMBRIDGE UNIVERSITY,, GB,<br>vol. 18, no. 3, 1981, pages 97-125,<br>XP000987086<br>page 99, column 1, paragraph 2 - paragraph<br>4<br>page 105, column 1, paragraph 1 -<br>paragraph 3<br>--- | 1-10                  |
| A        | SHAOJUN L ET AL: "CATIONIC POLYMERISATION<br>OF ISOBUTYLENE INITIATED BY<br>FULLERENES/TiC14 CATALYST"<br>RAPRA ABSTRACTS, PERGAMON PRESS LTD.<br>OXFORD, GB,<br>vol. 37, no. 1, January 2000 (2000-01),<br>page 34 XP000896203<br>ISSN: 0033-6750<br>* the whole text *         | 1-10                  |
| T        | JOURNAL OF THE AMERICAN CHEMICAL SOCIETY,<br>vol. 124, 29 August 2002 (2002-08-29),<br>pages 11266-11267, XP002241314<br>* the whole document *  | 1-10                  |

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/03/00067

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.: 14 because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
3.  Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1.  As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-10, 13

### Remark on Protest

The additional search fees were accompanied by the applicant's protest.  
 No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 14

The general structure (II) defined by a markush formula is missing a substituent. A meaningful search on the markush formula is therefore not possible. (The actual markush formula in claim 14 describes probably the olefin used to generate a cationic fragment and not the cationic fragment).

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-10, 13

A compound comprising a cation of the general structure (III); ( for details of the structure see definitins in claim 13)

2. Claim : 11

A metallorganic compound comprising a non-coordinating anion of the general cstructure [M<sub>2</sub>X<sub>9</sub>]<sup>-</sup> in which M is Zr or Hf and X is a halogen atom

3. Claim : 12

A method of homo- or copolymerizing an olefin in the presence of a compound comprising a non-coordinating anion of the general cstructure [M<sub>2</sub>X<sub>9</sub>]<sup>-</sup> in which M is Zr or Hf and X is a halogen atom